PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A63C 17/06 — A1

(11) International Publication Number: WO 98/09691

(43) International Publication Date: 12 March 1998 (12.03.98)

(21) International Application Number: PCT/US97/15786

(22) International Filing Date: 5 September 1997 (05.09.97)

(30) Priority Data:
60/025,545 6 September 1996 (06.09.96) US

(71)(72) Applicant and Inventor: LONGINO, Robert, Keith [US/US]; 3rd floor, 1056 N. Hermitage Street, Chicago, IL 60622-3259 (US).

(74) Agent: ANOLICK, Simon, B.; Gardner, Carton & Douglas, Suite 3400, 321 North Clark, Chicago, IL 60610-4795 (US).

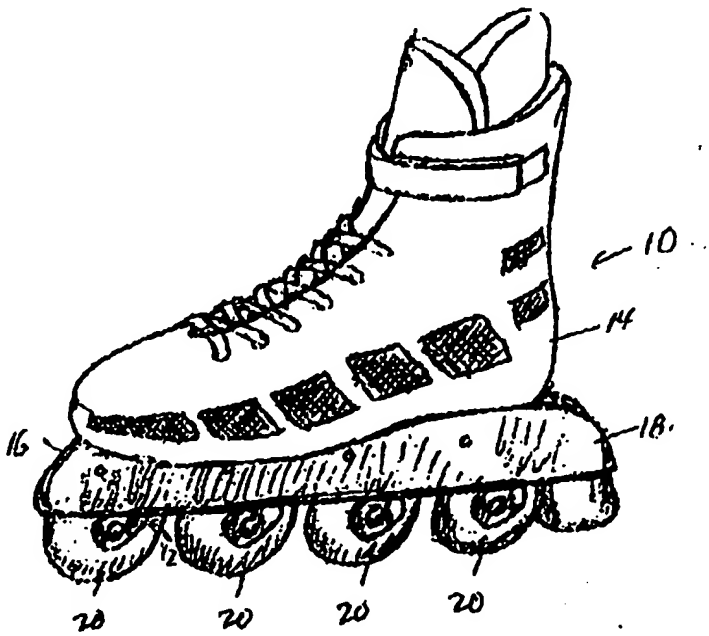
(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: INDEPENDENT SUSPENSION SYSTEM FOR IN-LINE SKATES

(57) Abstract

A suspension mechanism for in-line skates. The in-line skate includes a boot (14) and a tracking system (18) attached to the sole of the boot. The suspension mechanism includes an attachment mechanism (35) that connects to the tracking system at one end and the wheels (20) at another end. The suspension mechanism further includes a biasing member (39, 59, 98, 108) so that the wheels move individually relative to the boot when it encounters uneven surfaces.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

INDEPENDENT SUSPENSION SYSTEM FOR IN-LINE SKATES

BACKGROUND OF INVENTION

1. Field of the Invention.

The invention relates to in-line skates, and, in particular, to an independent suspension system to attach the wheels of an in-line skate to the skate's boot where the suspension system allows the wheels to move individually relative to the ground and the boot.

2. Scope of the Prior Art.

In-line skates have become very popular recreational and sporting equipment. They have essentially replaced regular roller-skates, and are used by speed skaters and ice-hockey players for dry-land activities. Many individuals and families use them for outings and exercise.

In general, in-line skates are used outside on sidewalks and other road surfaces. These surfaces are generally not flat and have bumps, ridges and holes. The uneven surfaces can cause stress on the wheels, boots and other structural elements of the skate as well as discomfortable for the skater. Often, the uneven surfaces can be treacherous for riding.

In the past, systems and mechanisms have been developed to assist in the breaking and steering of in-line skates. In addition, systems have been developed to improve the ride of the in-line skates. Some of these systems include a mechanism for the wheels to move relative to the boot, but they do not necessarily provide an adequate mechanism to improve the suspension of the in-line skate so that the skate will absorb the shocks caused on the skate by uneven riding surfaces.

SUMMARY OF THE INVENTION

The purpose of the present invention is to overcome the limitations of the prior art and to develop a suspension system for an in-line skate that improves the ride of the skate. The invention includes mechanism that allow the wheels to move relative to the boot of the skate so that when the wheels encounter uneven surfaces the wheels move individually and independently to overcome the uneven surface thereby providing a smoother ride. This arrangement reduces the impact and stress on the boot and, therefore, the impact and stress on the person using the skates. The suspension mechanism can be arranged so that the wheels can move in a dual action movement in more than one place.

The suspension mechanism, which allow the wheels to move relative to the boot, includes a biasing means that absorbs the shock when the wheels encounter the uneven surface and an attachment mechanism to connect the wheels to the boot. The biasing means can include a spring, flexible plastic or metal, or another type of energy absorbing system. In a typical in-line skate, the wheels are rotatably attached to a tracking system, which is, in turn, attached to the sole of the boot. In order to simplify the design of the suspension system, the present invention fits within the confines of the tracking system of a traditional in-line skate. Furthermore, the suspension mechanism is designed so that the dimensions of the skate, such as clearance from the ground, are not modified considerably. It is also desirable to design the suspension mechanism and the tracking system so that parts can be easily replaced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an in-line skate including a boot, tracking system, wheels and one embodiment of the suspension mechanism of the present invention;

FIG. 2 is a fragmentary view of suspension mechanism illustrated in FIG. 1;

FIG. 3 is a cross sectional view of the suspension mechanism taken along the line 2-2 in FIG. 2;

FIG. 4 is a perspective view of the wheel and attachment means of the suspension mechanism shown in FIG. 2;

FIG. 5 is a fragmented side view of another embodiment of the suspension mechanism according to the present invention;

FIG. 6 is a cross sectional view of the embodiment shown in FIG. 5 taken along the line 6-6.

FIG. 7 is a perspective view of the wheel and attachment means of the suspension mechanism shown in FIG. 5;

FIG. 8 is a fragmented side of yet another embodiment of the suspension mechanism of the present invention;

FIG. 9 is a front view of the suspension mechanism shown in FIG. 8;

FIG. 10 is a fragmented side view of still another embodiment of the suspension mechanism of the present invention;

FIG. 11 is a front view of the suspension mechanism shown in FIG. 10;

FIG. 12 is a perspective view of the wheel and attachment means of the suspension mechanism shown in FIG. 10;

FIG. 13 is a perspective view of a further embodiment of the suspension mechanism of the present invention;

FIG. 14 is a front view of the suspension mechanism shown in FIG 13;

FIG. 15 is a rear view of the suspension mechanism shown in FIG 13;

FIG. 16 is a side view of the attachment mechanism shown in FIG 13;

FIG. 17 is a side view of yet another embodiment of the suspension mechanism of the present invention and includes a partial cut-away view;

FIG. 18 is a top view of the suspension mechanism shown in FIG. 17; and

FIG. 19 is a perspective view of a portion of the attachment mechanism for the suspension mechanism shown in FIG. 17.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates an in-line skate 10 that includes a suspension mechanism 12 made in accordance with the principals of the present invention. The in-line skate 10 includes a boot 14 that is configured to hold and support the foot of the wearer. The boot includes a sole 16 that has a tracking system 18 attached to it. The tracking system 18 is made of any suitable material and is typically made of aluminum. The tracking system 18 has a series of wheels 20 rotatably attached to it so that the wheels form a line. In a traditional in-line skate 10, the wheel 20 can be rotatably attached to the tracking system 18 using axles 22. For the present invention, however, the wheels 20 are connected to the tracking system using a suspension mechanism 12. The suspension mechanism 12 allows the wheels 20 to move individually and independently relative to the boot 14 so that the in-line skate 10 can move smoothly over an uneven surface.

Figs 2-4 shows one embodiment of the suspension mechanism 12 according to the principals of the present invention. The suspension mechanism 12 includes an attachment mechanism 35. The attachment mechanism 35 is movably connected at one end to the tracking system 18 by a pin 37. The other end of the attachment mechanism 35 has the wheel rotatably attached to it by an axle 22. The attachment mechanism 35 is angled in between the tracking end and the wheel 20 end so that

when the wheel hits an uneven surface the suspension mechanism pivots about the pin 37 in an arcuate path. This arrangement reduces the shock created by an uneven surface to the boot 14. Each wheel 20 in the in-line skate 10 is connected to the tracking system 18 in a similar manner. Thus each wheel 20 can move individually and independently of the others relative to the boot.

In the preferred embodiment of this embodiment, the suspension mechanism 18 includes a biasing means 39 to absorb the pressure when the wheel 20 encounters an uneven surface and to hold the wheel in place. As seen in the figures, biasing means 39 can be a typical spring. Of course, any type of biasing means can be used such as flexible plastic, polyurethane, metal or another type of energy absorbing system. The biasing means 39 is connected between the tracking system 18 and the center portion of the attachment mechanism 35. The biasing means 39 is biased so that the wheel 20 is held in place during normal operation of the in-line skate 10 and absorbs the shock of the wheel 20 when the wheel 20 encounters an uneven surface. The biasing means 39 can also be biased to relieve the pressure on the boot 14 when the wheels 20 encounter the surface during the natural skating motion.

Figs. 5-7 illustrate another embodiment of the suspension mechanism 12 of the present invention. This embodiment includes an attachment mechanism 35 that has a arcuate-shape. The attachment mechanism is connected to the tracking system 18 at a point between the ends by a pin 37. One end of the attachment mechanism 35 is connected to a biasing means 39 which is engaged to the tracking system 18. The tracking system 18 also includes a channel 41 to position the attachment mechanism 35. The wheel 20 is rotatably connected to the other end of the attachment mechanism by an axle 22. In this arrangement the attachment mechanism 35 pivots

about the pin 37 when the wheel encounters an uneven surface. The biasing means 39 is biased to absorb the shock and movement of the attachment mechanism. When the biasing means 39 returns the channel 41 positions the attachment mechanism 35 and wheel 20 to its original position. The biasing means 39 can also be configured to absorb the shock of the wheels encountering a surface during the skating motion of the user. Of course, another sort of biasing means 39 other than a spring shown can be used.

Figs. 8-9 illustrate yet another embodiment of the suspension mechanism 12 of the present invention where the wheels 20 move in a vertical pattern when they encounter uneven surfaces. The attachment mechanism 35 includes a channel 45 portion that is rigidly connected to the tracking system at its closed end. The open end of the channel includes ribs 43 that are perpendicular to the sides 49 of the channel 45. A mating member 51 is movably engaged at one end into the channel of its upper end. The ribs 47 of the channel 45 hold the mating member 51 within the channel 45. The other end of the mating member is rigidly connected to a u-shaped bracket 53. The wheel 20 is rotatably connected to the bracket by an axle 22. Within the chamber 45 formed by the channel and mating member a biasing means 39 is positioned. As seen in the figures, the biasing means 39 can be any sort of energy absorbing system such as a spring or flexible material and be within the scope of the invention. The biasing means 39 is biased so that the wheel 20, bracket 53 and mating member 51 move vertically when the wheel 20 encounters an uneven surface. The biasing means 39 can also be configured to absorb the shock achieved when the wheels engage a surface during a normal skating motion.

Figs. 10-12 illustrates still another embodiment of the present invention where the wheels 20 pivot in an arcuate pattern. The attachment mechanism 35 includes a u-shaped end 55 that is connected to the wheel by an axle 22. The attachment mechanism 35 connects to the tracking system 18 by an arm 57 extending from a side of the u-shaped end 55. The arm 57 includes a series of holes 59 that are used to connect the attachment mechanism to the tracking system 18 by a screw 61. The different holes 59 in the arm adjusts the flexibility of the arm 59. A pin 63 is provided at the upper side of the u-shaped end 55 and fits into a hole 59 in the tracking system 18. The pin 63 provide stability for the attachment mechanism 35. When the wheel 20 encounters an uneven surface the arm flexes so that the wheel moves in an path while the pin 63 provide guidance and rigidity. The amount of shock absorbed by the attachment mechanism 35 depends on which hole the screw 61 is placed.

Fig. 13-16 illustrate a further embodiment of the present invention where the wheels 20 move in a vertical pattern when they encounter uneven surfaces. The attachment mechanism 35 includes an upper portion 70 that connects to the tracking system 18 and a lower portion 72 that connects to the wheel 20. The upper portion 20 includes a plate 74, which has a number of holes 76. From the opposing edges of the plate, side arms 78 extend perpendicularly. Screws (not shown) are placed through the holes 76 to attach the suspension mechanism 12 to the tracking system 18.

The lower portion 72 has a generally C-shaped cross-section that surrounds the wheel 20. The upper portion 70 and lower portion 72 are connected to one another by bars 80 and 82. Bars 80 and 82 connect one side of the C-shaped lower portion 72 to the arms 78 of the upper portion. Bars 80 and 82 are used on each side of the suspension mechanism 10 so that the wheels 20 move in a vertical pattern when they

encounter uneven surfaces. The bars 80 are connected to the lower and upper portion by pins 84 so that the bars 80 can rotate about the pins 82. One of the pins 84 can serve as an axle for the wheels 20.

The embodiment shown in FIGS. 13-16 includes a biasing means 39 that is biased between the plate 74 and the lower portion 72. The biasing means 39 is configured to absorb the shock and movement of the attachment mechanism and to permit the lower portion 72 to move vertically relative the upper portion 70 when the wheel 20 encounters an uneven surface. The biasing means 39 can also be configured to absorb the shock achieved when the wheels engage a surface during a normal skating motion.

The embodiment of the suspension mechanism 10 shown in FIGS 13-16 includes a stopping mechanism 86 that limits the vertical movement of the lower portion 72 relative the upper portion 70. The stopping mechanism 86 is formed from the arms 78 and the lower bars 82. At the lower end of each arm 78 a portion of the side is removed so that each arm 78 is L-shaped. The bars 82 are connected together by a bridge 86. This bridge 86 fits into the removed portion of the arms so that the bridge stops the movement of the of the lower portion 72 when it encounters the edge of the upper portion 78. The stopping mechanism 86 and the biasing means 39 work together to limit the motion of the wheel 20 when it encounters uneven surfaces. All embodiments of the present invention can include a stopping mechanism similar to the stopping mechanism 87 shown.

FIGS. 17-19 illustrate yet another embodiment of the present invention and provide a suspension mechanism 12 that has dual action movement so that the wheels 22 can move individually and independently in more than one direction. The tracking

system 18 includes a series of channels 92. The attachment mechanism 35 includes a live axle 94, which is shown in FIG. 18. The top end 96 of the live axle 94 connects to the upper surface of channel 92 and is supported by first biasing means 98 at either side. The first biasing means 98 also connects into the end walls of the channel 92. The opposite end of the live axle 92 includes a rod 100 and between the rod 100 and the top end 96 is a wedge 102.

The attachment mechanism 35 in this embodiment also includes a first arm 104 and a second arm 106. The first and second arms 104, 106 are both connected at one end to the rod 900 so that the arms rotate about the rod 100. The wheels are connected to the other end of the arms 104, 106 by axles 38. A second biasing means 108 can be configured between the arms 104, 106 and the wedge 102 to absorb the movement of the arms as they rotate about the rod 100 when the wheels engage on an uneven riding surface. In this arrangement, wheels 20 connected to arms 104 and 106 move in a clockwise and counter-clockwise arcuate path, respectively, about the rod 100. According to the connection between the live axle and the tracking system, the wheels can also move in a path relative to the top end 96, such that the top end 96 engages the first biasing means 98 to absorb the shock when the wheels 20 encounter an uneven surface. Both the first and second biasing means 98 and 108 are configured to keep the wheels in one position in the steady state.

I claim:

1. An in-line wheeled skate comprising:

a boot;

a plurality of wheels;

a suspension mechanism for movably connecting each of the wheels to the boot so that the wheels move independently relative to the boot.

2. The in-line skate according to claim 1 wherein the suspension mechanism allows the wheels to move in an arcuate path relative to the boot.

3. The in-line skate according to claim 1 wherein the suspension mechanism allows the wheels to move in a vertical path relative to the boot.

4. The in-line skate according to claim 1 wherein the suspension mechanism further comprises an attachment mechanism to connect the wheels to the boot.

5. The in-line skate according to claim 2 wherein the attachment mechanism having parallel L-shaped legs and further comprising:

a tracking system attached to the boot; and

a tab at one end of each parallel leg to connect each leg to the tracking system by a pin so that the wheel moves about the pin in an arcuate path.

6. The attachment mechanism according to claim 4 wherein the attachment mechanism comprises:

a channel portion having a closed end connected to the boot and an open end opposite the closed end;

a mating member movably engaged with the channel; and

a U-shaped bracket to connect the wheel to the mating member.

7. The in-line skate according to claim 1 wherein the suspension mechanism further comprises a biasing means to restrict the movement of the wheels.

8. The biasing means according to claim 7 wherein the biasing means is composed of polyurethane material.

9. The biasing means according to claim 7 wherein the biasing means is biased against the boot.

10. An in-line skate comprising:

a boot;

a plurality of wheels;

a plurality of suspension systems for movably connecting the wheels to the boot so that the wheels move relative to the boot, the system having an attachment mechanism connected to the boot and an arm between the attachment mechanism and each wheel.

11. The in-line skate according to claim 10 wherein the suspension system allows each of the wheels to move independently in an arcuate path relative to the boot.

12. The suspension system according to claim 10 wherein the attachment mechanism allows the wheels to pivot about an axis formed where the attachment mechanism connects to the boot.

13. The suspension system according to claim 10 further comprising a biasing means to limit the movement of the wheels.

14. The suspension system according to claim 10 wherein the attachment mechanisms are opposing hinges.

15. The suspension system according to claim 14 further comprising a biasing means to restrict the movement of the attachment mechanisms.

16. The biasing means according to claim 15 wherein the biasing means is biased against the boot.

17. The biasing means according to claim 15 wherein the biasing means is composed of a polyurethane material.

18. An in-line skate comprising:

a boot;

a plurality of wheels;

a plurality of dual action suspension systems for movably connecting the wheels to the boot so that the wheels move relative to the boot, wherein each suspension system includes a live axle that allows the wheels to rotate about a first end of the live axle as part of the dual action movement, and a first and a second arm, each arm being connected to a second end of the live axle so that in addition to the concurrent movement each wheel is able to rotate independently about the second end.

19. The in-line skate according to claim 18 wherein the suspension system further comprises a biasing means to restrict the movement of the arms about the first end of live axle.

20. The in-line skate according to claim 18 wherein the suspension system further comprises a second biasing means to restrict the movement of the arms along an arcuate path relative the second end of the live axle.

FIG. 1

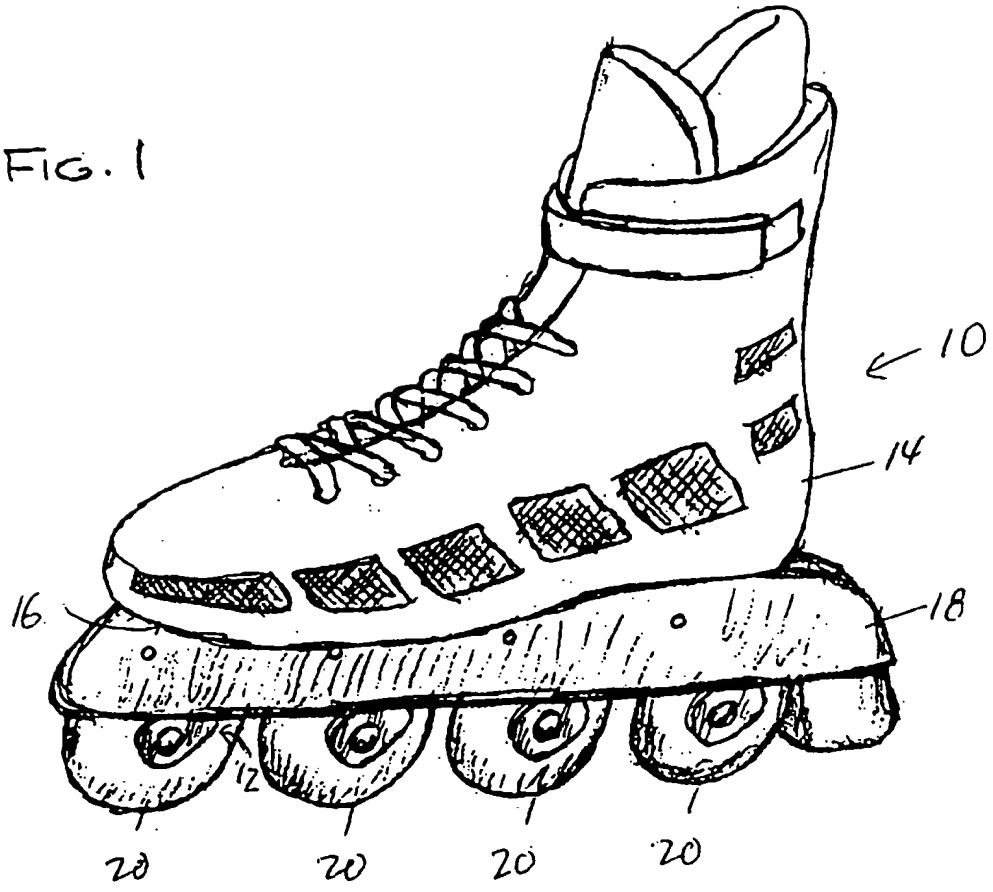


FIG. 2

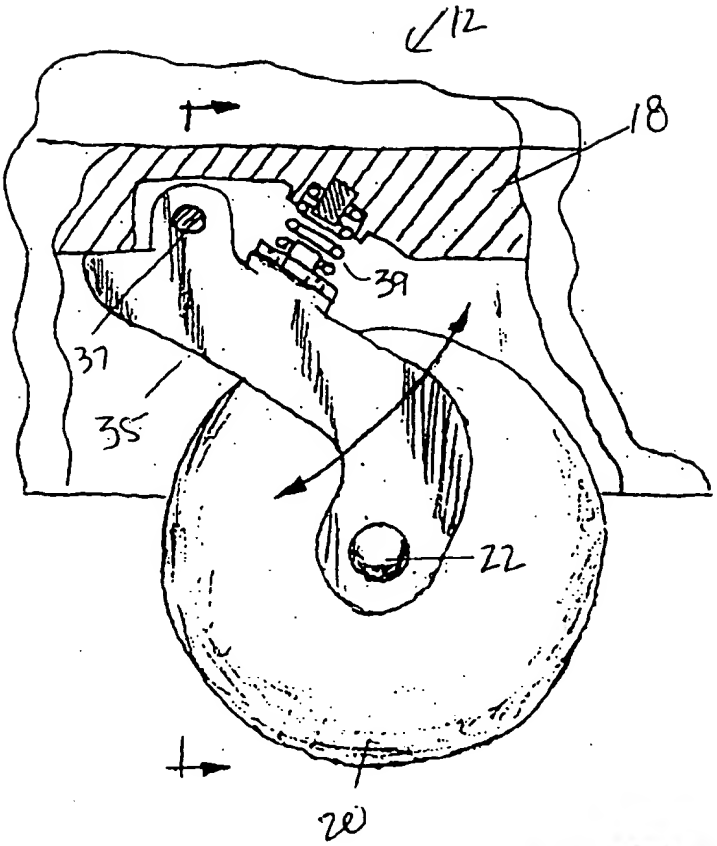


FIG. 3

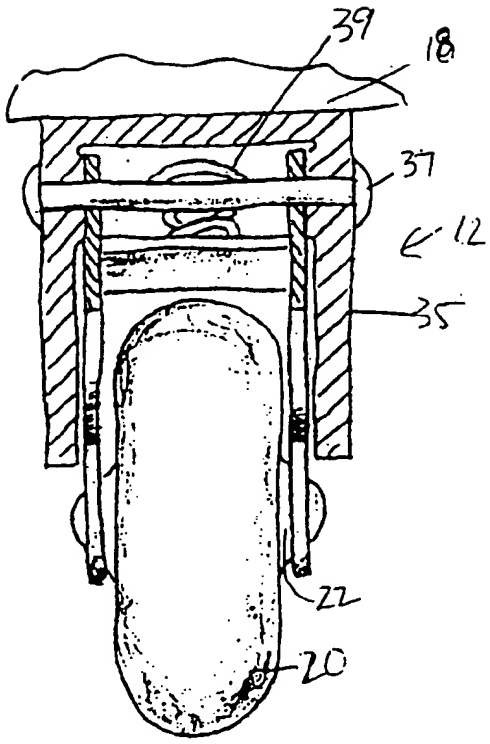
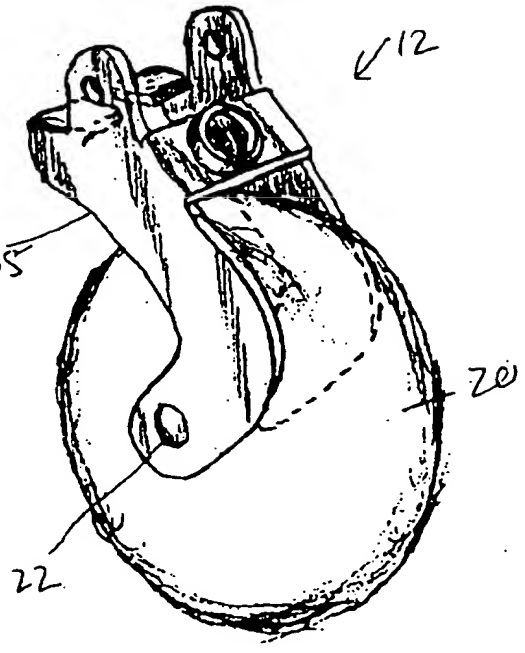


FIG. 4



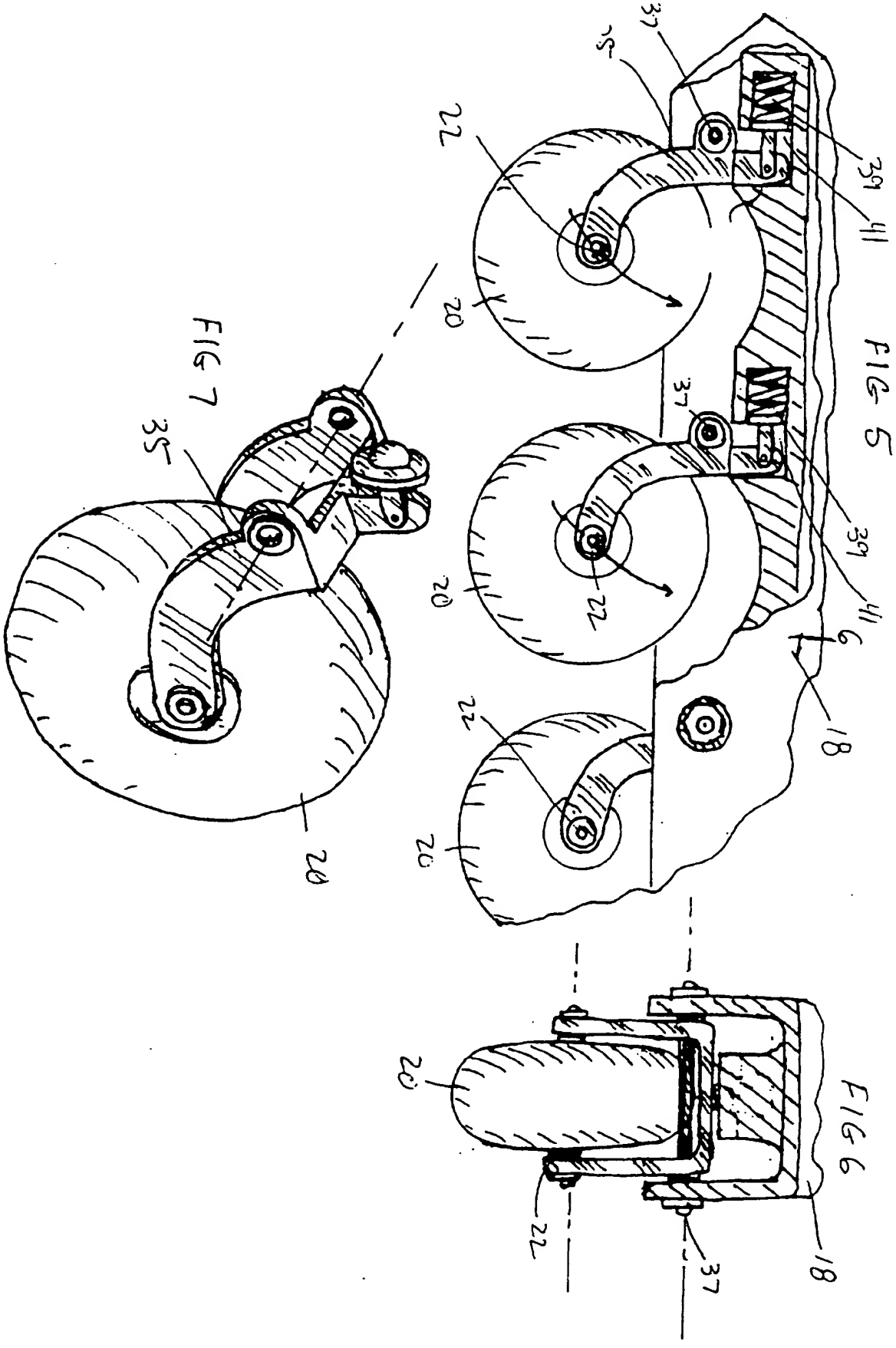

37
35
22
39
41
20
18
FIG 5
FIG 7
FIG 6

FIG 8

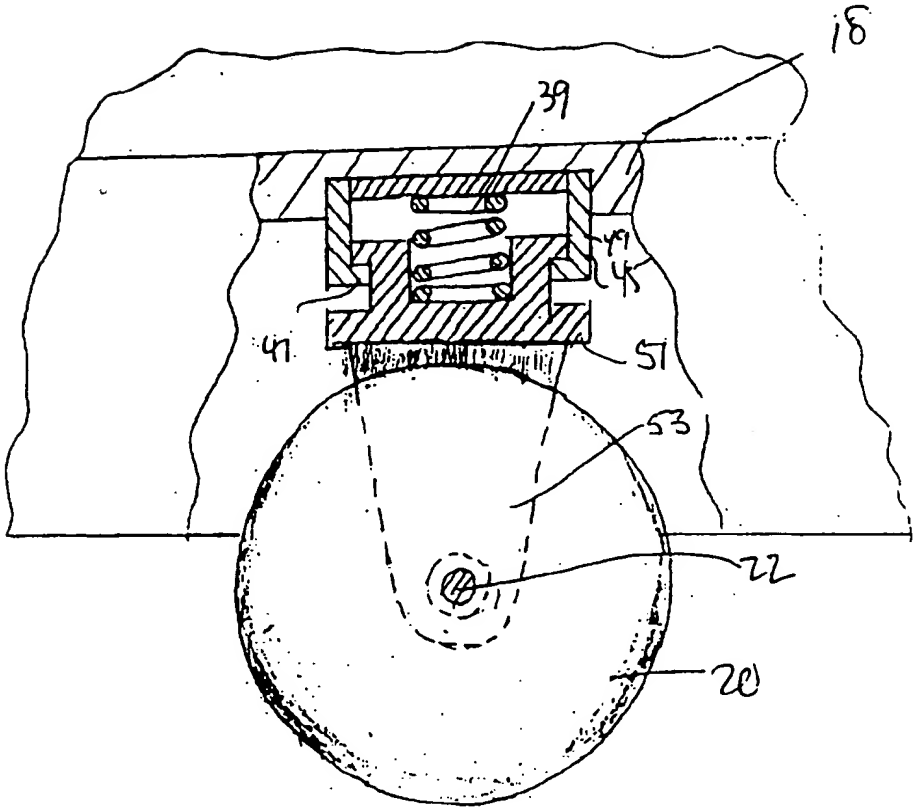
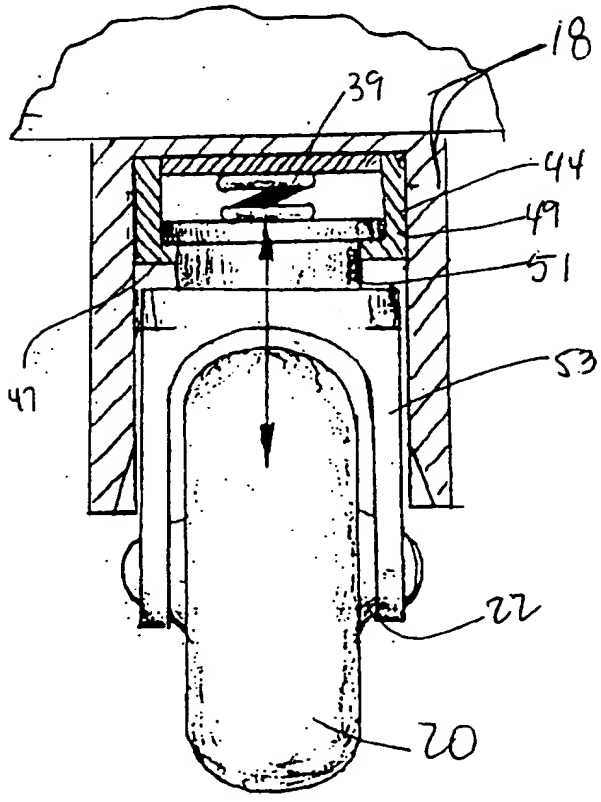


FIG. 9



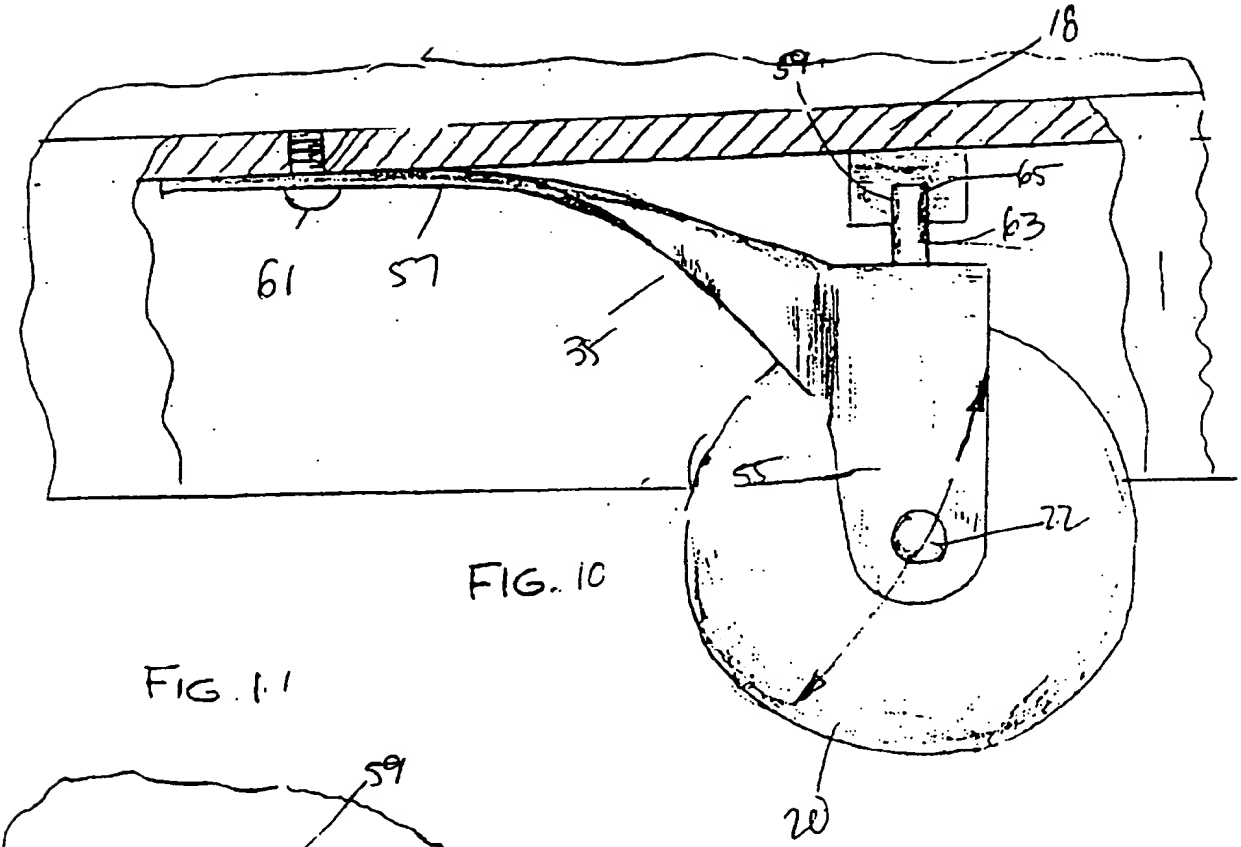


FIG. 10

FIG. 11

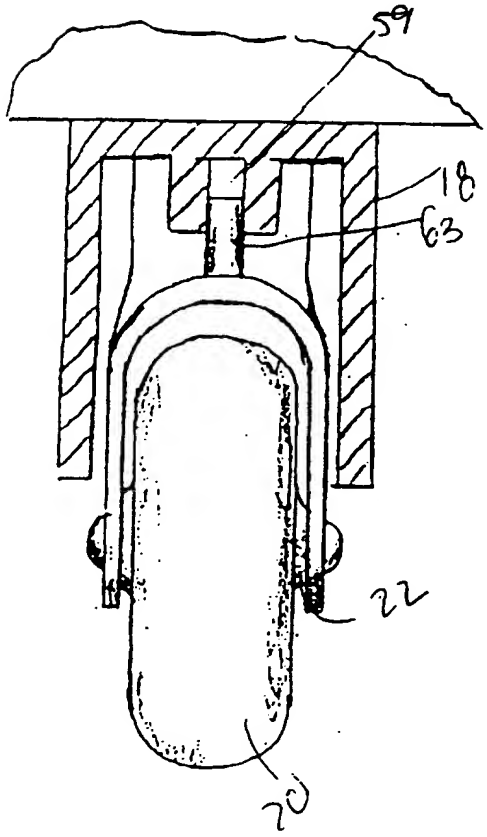


FIG. 12

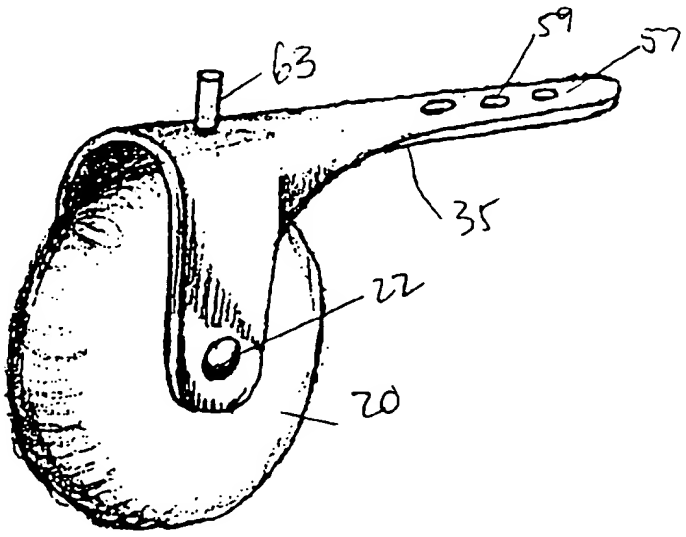


FIG13

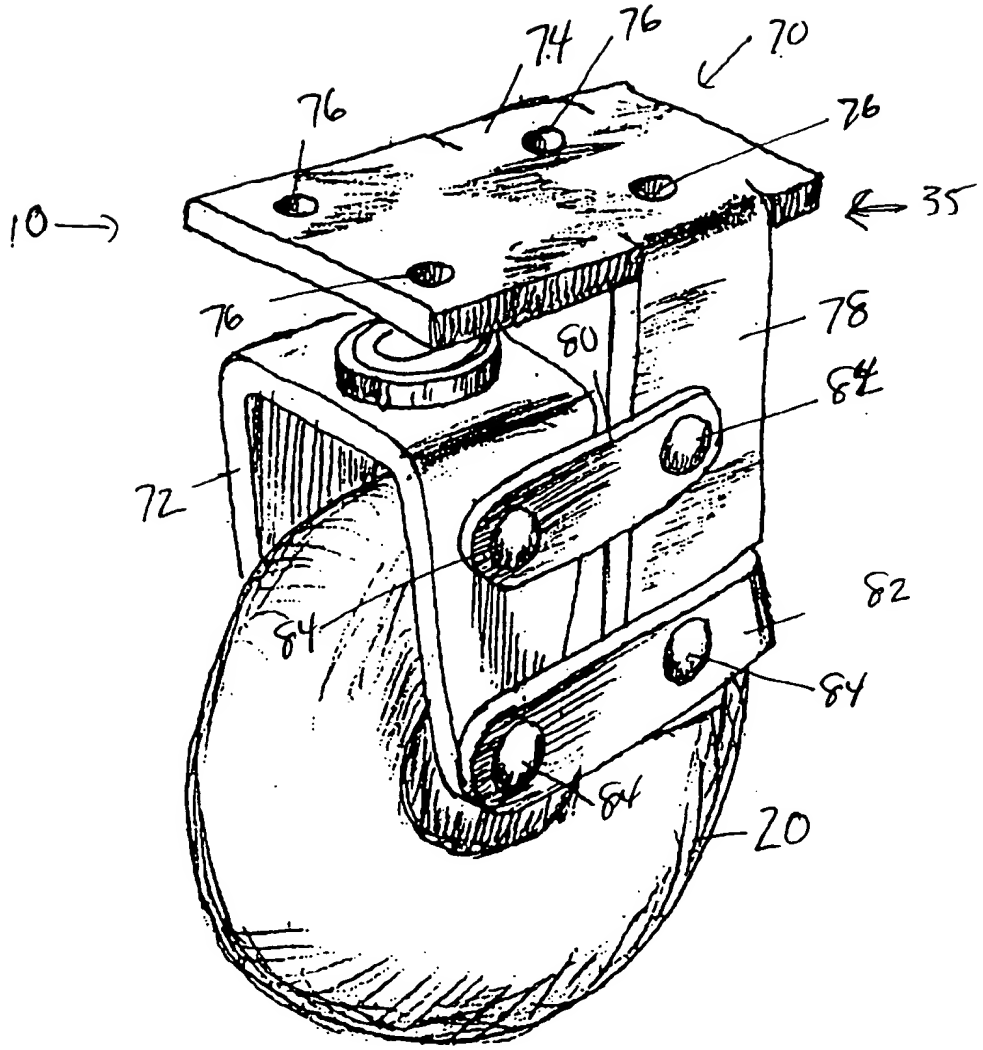


FIG 15

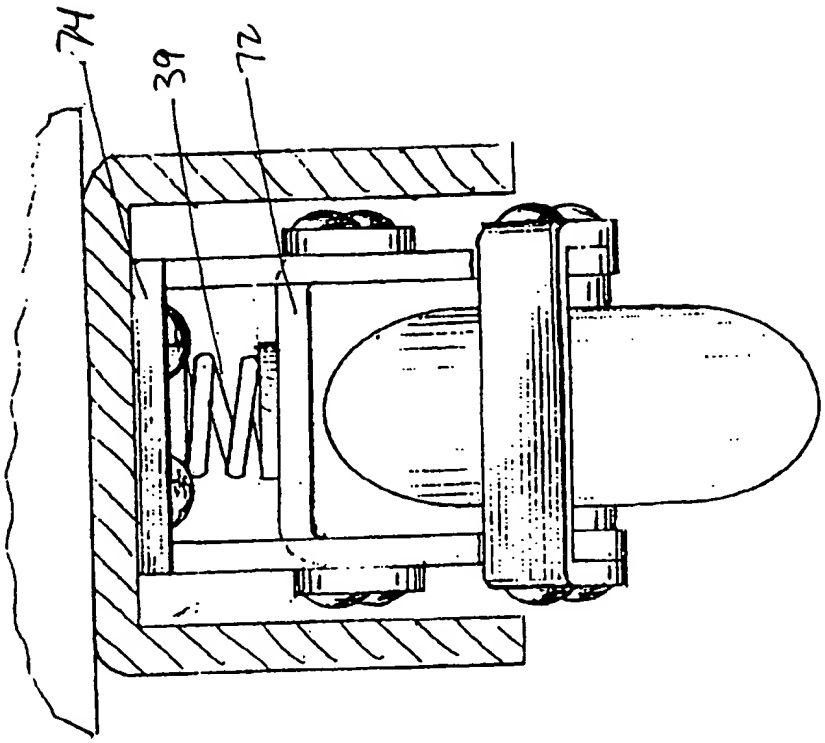


FIG 14

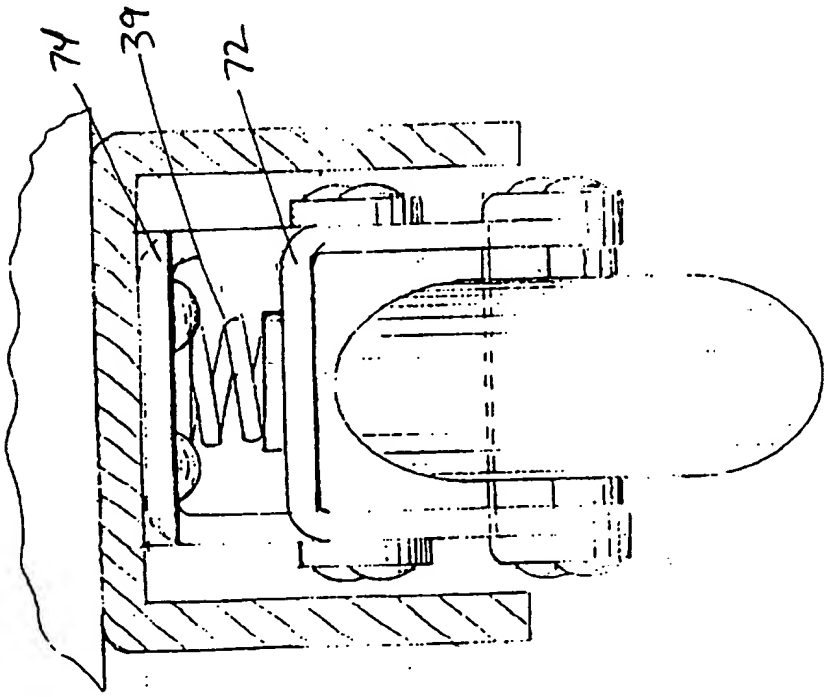
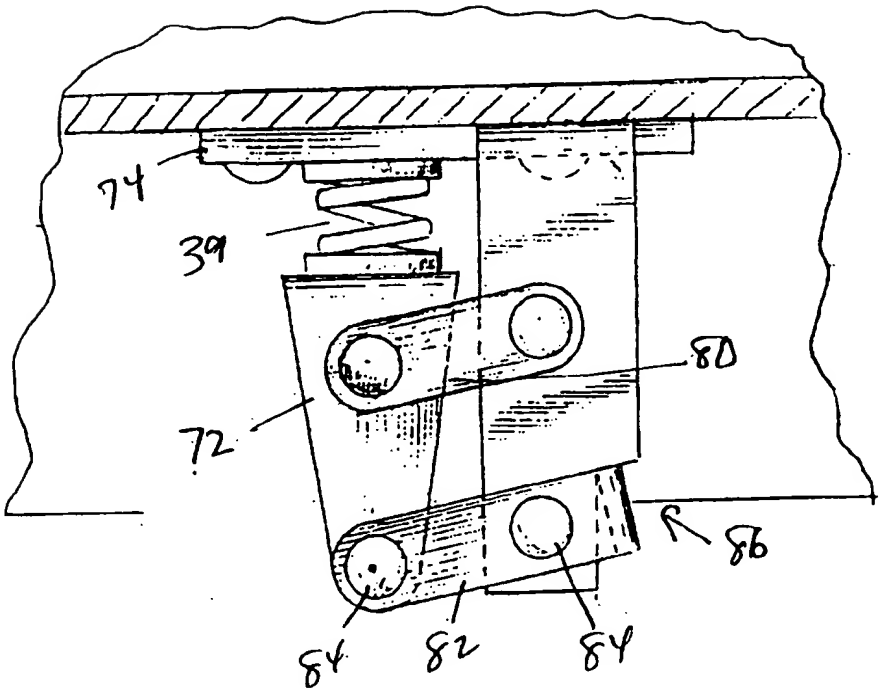


FIG.16



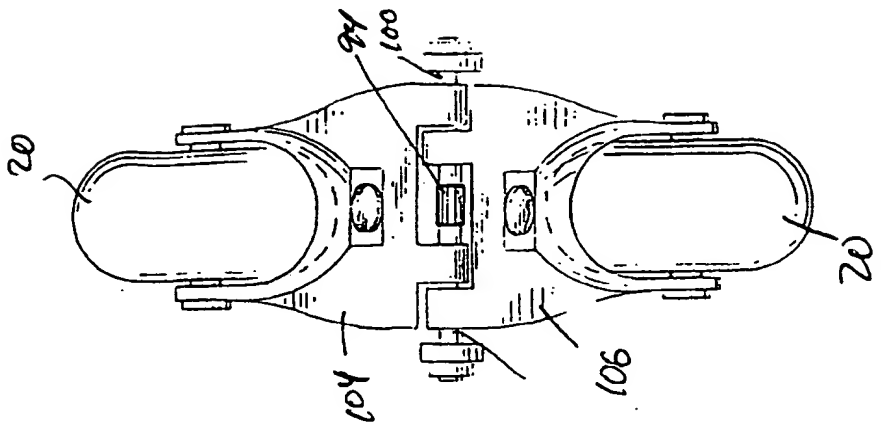


FIG. 18

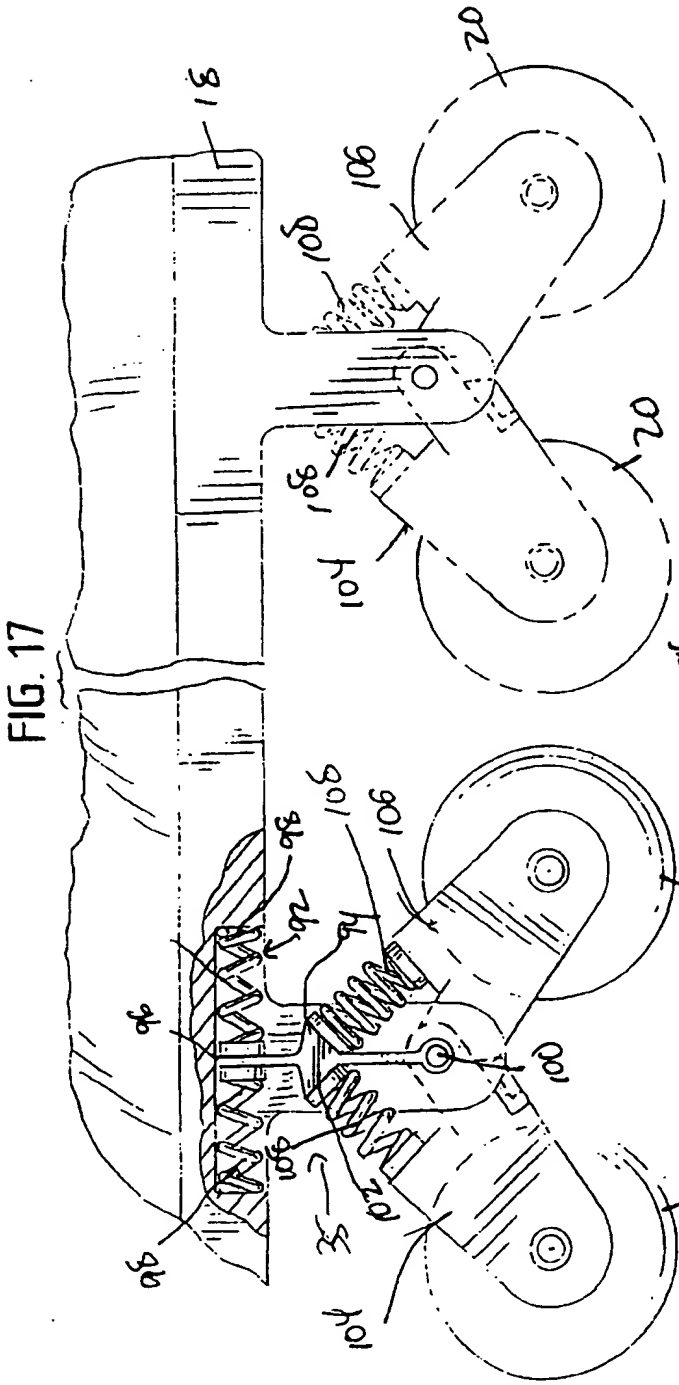


FIG. 17

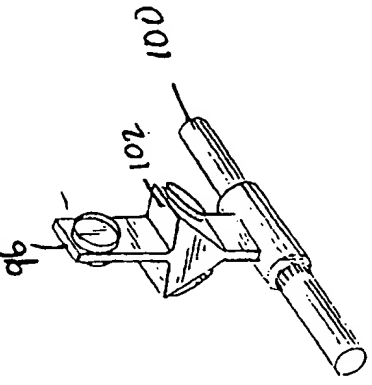


FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/15786

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A63C 17/06
US CL :280/11.22, 11.28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 280/11.22, 11.28, 842, 11.23, 11.27

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,342,071 A (SOO) 30 August 1994, see Figs. 5 & 6	1, 2, 4, 7-17 — 5
X — Y	US 5,085,445 A (BOYDEN) 04 February 1992, see Fig. 2	1, 3, 4 — 6
Y	US 4,351,538 A (BERTA) 28 September 1982 see entire document	5
X	US 5,135,244 A (ALLISON) 04 August 1992 see entire document	18, 19

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 OCTOBER 1997	24 NOV 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer BRIAN L. JOHNSON Telephone No. (703) 308-1113

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/15786

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,501,474 A (CONTE) 26 March 1996 see entire document	6
A	US 2,572,133 A (GLENN) 23 October 1951	
A	US 904,270 A (LIPPY) 17 November 1908	
A	US 2,644,692 A (KAHLERT) 07 July 1953	
A	US 4,272,090 A (WHEAT) 09 June 1981	
A	US 5,390,958 A (SOO) 21 February 1995	
A	US 4,402,521 A (MONGEON) 06 September 1983	